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CATTLE SCAB

AND METHODS OF CONTROL AND ERADICATION

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Zoological Division

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UNITED STATES DEPARTMENT OF AGRICULTURE

Contribution from the Bureau of Animal Industry
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CATTLE SCAB is a contagious skin disease affecting cattle of all classes, ages, and conditions. It is caused by minute parasites or mites, several species of which affect cattle. The nature and habits of the mites, the symptoms caused by each species, and methods of distinguishing the different kinds of cattle scab are described in this bulletin.

Scab is injurious to all classes of cattle, but the greatest injury occurs among bulls and old or weak animals of low vitality. Money losses are caused by irritation, shrinkage in weight, unthrifty condition, arrested growth, functional disturbances, low vitality, and increased death rate.

Cattle scab can be eradicated by dipping or spraying, but dipping is the better method of treatment. Lime-sulphur dips, nicotin dips, and crude-petroleum dips are efficacious. Methods of preparing and using these dips are described and the intervals between dippings and the conditions under which the various dips may safely be used for the different kinds of scab are discussed. Also, plans of cattle-dipping plants and directions for building vats and dipping cattle are given.

CATTLE SCAB AND METHODS OF CONTROL AND ERADICATION.

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VARIETIES AND GENERAL CHARACTERISTICS.

SCABIES IN CATTLE, commonly known as "scab," "mange," or "itch," is a name given to a group of contagious skin diseases caused by insectlike parasites known as "mites" which live on or in the skin. The four species of these parasites which affect cattle are classified zoologically in four different genera as follows: First, *Psoroptes;* second, *Sarcoptes;* third, *Chorioptes*, and fourth, *Demodex.*

In obtaining their food from the tissues of the host animal the mites cause wounds or lesions in the skin, and as each kind of mite possesses distinctive habits the nature and location of the lesions in the early stages are more or less characteristic. The psoroptic mites, which cause common scab, live in groups or colonies on the surface of the skin, and the lesions caused by them spread in all directions from the spot first affected. The sarcoptic mites burrow into the skin, each female making a separate gallery in which she lays her eggs. The chorioptic mites live in groups on the surface of the skin but usually remain localized on the limbs or tail with little or no tendency toward spreading. The demodectic mites, which are much smaller than the other mites under discussion, being truly microscopic in size and in appearance more like worms than typical mites, live in the hair follicles and sebaceous glands, the evident lesions consisting of small spherical swellings or pustules in the skin.

PSOROPTIC OR COMMON SCAB.

Psoroptic or common scab occurs in cattle much more frequently than any of the other varieties, and although not so dangerous a disease as sarcoptic scab, because of its greater prevalence it causes larger losses to the cattle industry than the latter. In the western

part of the United States, especially where cattle graze on the open ranges, the losses caused by common scab have been a serious drawback to the industry, but through the cooperative work of the Bureau of Animal Industry and the officials of the States concerned the disease has been greatly reduced and brought under control in those areas where formerly it occurred very frequently. It has not, however, been entirely eradicated from the herds of the Western States, and it is important to eradicate the disease completely in order to prevent it from again becoming prevalent. In the farming communities common scab occasionally is found on cattle in various sections of the country, where, unless properly treated, it causes great losses.

When allowed to spread common scab becomes a serious disease affecting cattle of all ages, classes, and conditions. The losses are caused by shrinkage in weight, failure of young stock to thrive and gain weight normally, and by an increase in the death rate of poorly nourished animals of low vitality, especially range cattle exposed to inclement weather.

THE PARASITE WHICH CAUSES COMMON SCAB.

The mites which cause common cattle scab are small, white, or yellowish-colored parasites known technically as *Psoroptes equi bovis* or more often as *Psoroptes communis bovis* (fig. 1). The female when full grown measures about one-fortieth and the male about one-fiftieth of an inch in length. They are visible to the naked eye, especially when they are placed on a dark background. The general form of the body is oval or egg-shaped and the tapering head is longer than broad. These mites when mature have four pairs of legs, all of which extend beyond the margin of the body.

The entire life cycle is passed on the body of the host animal. Each female may deposit from 15 to 24 eggs, which hatch after 3 or 4 days' incubation. The young mites reach maturity, mate, and the females deposit eggs in from 10 to 12 days. These stages in the life history have an important bearing on the interval which should elapse between treatments.

Dipping if properly done will kill all the mites but can not be depended upon to destroy all the eggs. Some of the eggs will survive dipping and they may hatch after the first dipping, forming a new generation of mites. To complete the treatment this new generation should be destroyed by a second dipping before they have had time to develop and deposit eggs.

As the period of incubation on the host is from 4 to 7 days and probably never exceeds 10 days, and as the young mites do not begin depositing eggs until they are 10 or 12 days old, it is evident that the interval between the first and second dippings should be from 10

to 12 days. Practical experience has shown that the interval between dippings may be extended safely to a maximum of 14 days; however, the 10 to 12 days' rule should be followed whenever possible.

SYMPTOMS OF COMMON SCAB.

The mite which causes common cattle scab may attack any part of the body covered thickly with hair, but the first lesions usually occur on the withers, on top of the neck just in front of the withers, or around

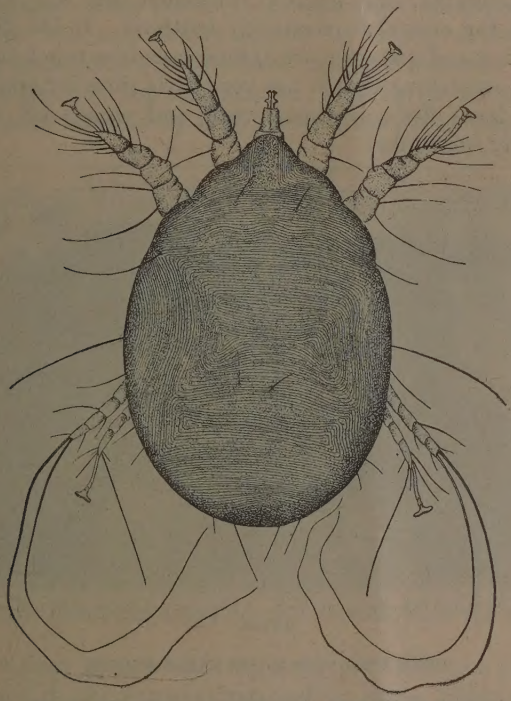

FIG. 1.—Psoroptic scab mite. Female. Magnified 100 times.

the root of the tail. From these points it spreads over the back and sides and unless checked it may involve practically the entire body.

When a scab mite finds lodgment on the body it pricks the skin to obtain food and in so doing probably introduces a poisonous secretion into the wound. A slight inflammation is caused, but this early stage of the disease is rarely, if ever, detected by casual observation. As the mites multiply, large numbers of small wounds are made in the skin and are followed by intense itching, formation of papules, inflammation, and exudation of serum. The serum which oozes to the surface becomes mixed with particles of dirt and more or less infected with microorganisms. This mass soon hardens into yellowish or

gray-colored scabs which frequently are stained with blood. In the early stages of the disease the scab may be about the size of a pea, but as the mites seek the healthy skin around the edges of the wound the scab or lesion gradually increases in size.

Some of the mites migrate to other parts of the body and start new lesions, which extend until they cover large areas (fig. 2). As the disease advances increasingly large areas become denuded of hair and covered with thick, adherent crusts or scabs. The skin becomes tumefied, corrugated, and greatly thickened (fig. 3). The itching is severe and the animal is constantly irritated. In its efforts to relieve the itching and irritation the animal spends so much time licking, rubbing, and scratching that it has very little time for grazing. Consequently it loses flesh, becomes weak and emaciated, and unless relieved finally succumbs.

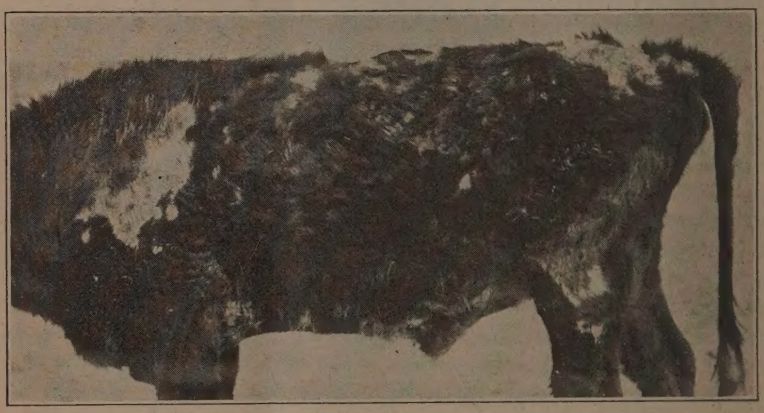

FIG. 2.—A well-developed case of common scab. A steer can not thrive while suffering from this disease.

DETECTING SCAB IN ITS EARLY STAGES.

The most certain diagnosis consists in demonstrating the parasite which causes the disease. This may be done by scraping the outer edges of the infected areas with a blunt-edged knife and transferring the scrapings to a smooth, black surface, such as a piece of black paper. Spreading the scrapings in the warm sun or near artificial heat usually causes the mites to become active and they can be seen as minute, gray, moving bodies against the dark background. They are quite plainly visible under a low-power hand lens. By parting the hair of infected animals and removing the small scabs the mites can sometimes be seen on the underlying moist, red skin and removed upon the point of a knife blade for examination. When the mites are causing active irritation the surface of the skin around the edges of the lesion or under the small scabs is red and moist and under such conditions

the parasites usually are present in large numbers. On the other hand, if the lesions and surrounding skin are dry and dull in appearance, it indicates that the mites are inactive at that point and that they will be difficult to find.

Persistent licking, rubbing, or scratching is the first indication of scabies as well as of lousiness [1] and various other conditions, but if it is remembered that scabies is caused only by scab mites the diagnosis is rendered more simple. Although the hair conceals the small scabs in the early stages of the disease, its disarranged condition over the lesion indicates the area which should be closely examined. By manipulating such areas with the hand the dried serum or scabs may be found and removed for examination, and search made for mites. The areas of skin affected by scab become thickened and hardened.

Fig. 3.—A case of common scab, showing characteristic wrinkles on neck and shoulder.

This condition may be detected readily by pinching up a portion and comparing it with the surrounding healthy skin. Other conditions resembling scab rarely if ever cause this characteristic, uniform thickening of the skin.

Well-advanced cases of scab usually are easy to diagnose, but the disease should never be allowed to reach this stage, because in the early stages it yields readily to proper treatment, and if allowed to spread it entails heavy losses.

CONTAGIOUSNESS OF COMMON SCAB.

Each species of domesticated animal has its own peculiar variety of psoroptic scab, and common cattle scab is not transmissible to other species of animals. It is, however, contagious to all classes of cattle

[1] See Farmers' Bulletin 909, "Cattle Lice and How to Eradicate Them."

and is transmitted by direct contact with animals or objects that are carriers of the mites. The disease spreads much more rapidly among closely confined cattle than among those on the open range or in large pastures. Although the disease develops much more rapidly and is more severe in its effects on old, weak, or poorly nourished animals of low vitality, nevertheless feed-lot animals in full vigor often become infected to such extent that they do not thrive or gain weight normally even when on full feed. Bulls, old cows, and unthrifty cattle usually are the first members of the herd to contract the disease, and during the winter season the contagion spreads rapidly from them to other cattle with which they come in contact. Visible lesions of scab may develop in from 15 to 45 days after exposure, or a much longer time may elapse before the exposed animals show indications of infection.

The transmissibility of the disease to a herd is not limited to any one season of the year, although cattle in a thriving condition on green, succulent feed seldom contract scab. In fact, in the spring, when infected cattle are turned out on green grass and the old coat of hair is shed, the disease often assumes the appearance of having been cured; usually, however, it will break out again with the coming of cold, stormy weather.

One or more attacks of the disease do not confer immunity, and after cattle have been treated and the disease cured they may become reinfected by contact with infected animals or by confinement in inclosures in which infected cattle recently have been kept. Though the most important factor in spreading scab mites is the infected animal, the possibility of cattle becoming infected from infectious premises should not be overlooked. Although the mite will not propagate itself except on the bodies of cattle, it is able to live for 2 or 3 weeks when removed from cattle, and under favorable conditions may live much longer. Dislodged eggs which drop in moist, protected places may retain their vitality for from 2 to 4 weeks during mild weather. In dry places exposed to bright sunlight the mites and eggs are destroyed in a few days. Owing to the varying conditions which may affect the longevity of the mites and the viability of their eggs when separated from their host, it is impossible to state definitely how long infection persists in infected inclosures after removal of the cattle.

It is advisable, therefore, to clean and disinfect all infected sheds, barns, yards, or small inclosures before using them for clean or dipped cattle. Remove all litter and manure, cleaning down to a smooth surface, then spray all walls, woodwork, and floors with a good disinfectant. The coal-tar-creosote dips and disinfectants diluted in accordance with instructions on the container are suitable for this purpose. All litter and manure from infected premises should be

spread on the ground and plowed under or disposed of in such manner that cattle can not come in contact with it, and all equipment such as currycombs, brushes, blankets, etc., used on or around infected animals, should be immersed in the disinfectant. An economical and effective method of disinfecting stone or wire-fence corrals is to scatter straw or similar material on the surface of the ground and burn it. If the material is dry enough to burn readily, sufficient heat will be produced to destroy the infection.

TREATMENT OF COMMON SCAB.

The only rational treatment for scabies consists in using some external application which will kill the parasites without injuring the animals. Internal remedies, such as sulphur and salt and various other preparations, have not proved to be effective in practice and they should not be depended upon. Cases of common cattle scab are easily cured if proper treatment is applied before the disease becomes advanced.

The dips commonly used and permitted by the Bureau of Animal Industry for use in official dippings of cattle for scabies are lime-sulphur and nicotin solutions. Two dippings, from 10 to 14 days apart, in one of these dips can usually be depended upon to cure cases of common scab.

SARCOPTIC SCAB.

DISTRIBUTION AND ECONOMIC IMPORTANCE.

Sarcoptic scab or mange, commonly known in some regions as "barn itch," is found more or less frequently on both farm and range cattle throughout the country. Though it has not become prevalent in any one section, it seems to be increasing among farm cattle east of the Missouri River as well as among cattle on the ranges of the West, especially in the southwestern part of the United States. The disease sometimes develops in pure-bred cattle, and animals shipped from herds of that kind may carry the infection although they may not show visible symptoms of scab at the time they are shipped. Pure-bred bulls of the beef breeds seem to be especially susceptible and they are an important factor in spreading the disease.

Owing to its comparative rarity sarcoptic scab in cattle had not been considered of much importance in the United States but during the last few years the disease has been on the increase and it has become a factor to be reckoned with. The disease is more serious than common scab because it is more severe in its effects and more difficult to eradicate. When introduced into a herd the infection may persist for years and cause very great losses unless proper methods of treatment and sanitation are adopted. The losses are caused by irritation, unthrifty condition, arrested growth, decreased vitality, functional disturbances, and increased death rate. The breeder of pure-bred cattle

who supplies bulls for grading up range and farm herds finds his business very nearly ruined when sarcoptic scabies develops in his herd. In dairy herds it may affect milk production seriously and throw the balance on the wrong side of the ledger. The disease, however, can be eradicated, and if proper methods are adopted before it becomes advanced the losses can be reduced to a minimum.

THE SARCOPTIC SCAB MITE.

The parasites which cause sarcoptic scab are known technically as *Sarcoptes scabiei bovis* (fig. 4), and they resemble in a general way the common scab mites. They are slightly smaller than the latter, the mature female measuring about one-fiftieth and the male about one-sixtieth of an inch in length. The general form of the body is more nearly round than oval and the bluntly rounded head is as broad as it is long. When mature these mites have four pairs of short, thick legs, the fourth pair and usually the third pair not extending beyond the margin of the body. A conspicuous feature under a high-power microscope is the presence of a number of short, backward-projecting spines on the upper surface of the body of the mite.

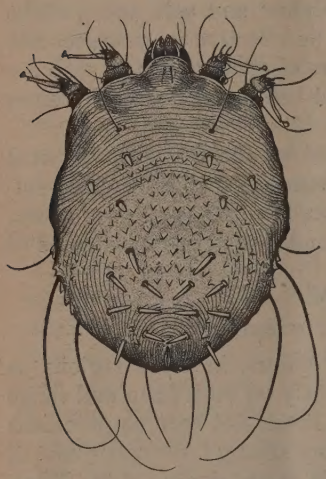

Fig. 4.—Sarcoptic scab mite. Female. Magnified 100 times.

As in the case of the common scab mite, the entire life cycle of the sarcoptic mite is passed on the body of the host animal. The sarcoptic mites, however, do not remain on the surface but penetrate through the upper layer of the skin and excavate burrows or galleries in which the mating of the sexes occurs and the eggs are laid. Each female may lay from 10 to 25 eggs during the egg-laying period, which probably lasts from 12 to 15 days. When the egg-laying period is completed the female dies in her burrow. The eggs hatch in from 3 to 10 days and the young mites after passing through several molts reach maturity and begin laying eggs in 10 or 12 days. As the surface of the skin constantly is wearing away and being renewed from below, the young mites are close to the surface when they hatch out. They can escape easily from their shallow burrows, and it is probable that at least a part of their life before egg laying begins is spent on or near the surface. The young mites form new burrows in which they deposit their eggs.

As the average period of incubation on the animal is about 4 days and the average period after hatching until egg laying begins is about 11 days, a new generation of mature mites may be produced by each fertile female in about 15 days. As the commonly used dips, however, will not always penetrate to the bottom of all burrows and kill all the mites at one application, the interval between dippings can not be calculated so accurately for sarcoptic mites as for psoroptic mites. Practical experience has shown, however, that when two or more dippings are given the interval between dippings should be from 6 to 10 days.

FIG. 5.—A case of sarcoptic scab, showing characteristic appearance of skin on inside of left hind leg.

SYMPTOMS OF SARCOPTIC SCAB.

The mites which cause sarcoptic scab in cattle prefer locations where the skin is tender and the hair is thin. In the early stages of the disease the lesions usually are found on the inner surfaces of the thighs (fig. 5), the underside of the neck or brisket, or around the root of the tail. From these parts the disease extends until the entire surface of the body may become involved. The parasites burrow into the skin, each one making a separate gallery, and the skin over each burrow becomes inflamed and swollen. These swollen areas or papillæ are somewhat larger than pinheads and often have a yellowish-colored granule of dried serum adhering to them. As the mites multiply the diseased area increases and the granular, conical papillæ or raised areas become closer together. The hair over the affected part stands erect and some of it drops out or is rubbed off, though usually a few scattering hairs remain even in advanced cases. In some cases the affected areas of skin take on a dry, scurfy, or leatherlike appearance, especially when the mites are not very active.

To relieve the intense itching the animal licks, scratches, and rubs the affected parts until the skin becomes raw. The mechanical injury thus caused results in a running together of the small granular areas, and large scabs are formed. When the disease reaches this stage it

resembles common scab and can be differentiated from it only by identifying the mite.

As the disease advances the skin becomes more or less bare and is greatly thickened and thrown into wrinkles or folds. The furrows caused by the wrinkles are thickly inhabited by mites, and scrapings taken from the bottom of a fold usually contain the parasites in abundance. In severe cases the animals lose flesh, become emaciated and greatly weakened, and unless properly treated many of them will die.

Typical cases of sarcoptic scab in the early stages may be distinguished from common scab by the location and character of the lesions and the manner of spreading, but usually it is difficult to differentiate between the two diseases without first identifying the mites.

For practical purposes in the field, where facilities for examination are limited, the principal differences in form and structure of the two species of mites may be summarized thus: The sarcoptic mite is slightly smaller than the common scab mite and the body of the former is more nearly round than oval, while in the latter it is egg-shaped or oval. Adults of both species have four pairs of legs, those of the psoroptic mites being long, and all four pairs extend beyond the margin of the body. The sarcoptic mites have shorter legs and the fourth or hind pair and usually the third pair do not extend beyond the margin of the body. The head of the common scab mite is tapering or cone-shaped and is longer than it is broad, while that of the sarcoptic variety is bluntly rounded in front and is as broad as long.

It is advisable to examine several specimens in all cases because the females of the two species are more easily distinguished from one another under low-power magnifying glasses than the males. On account of the burrowing habits of the sarcoptic mites they are difficult to find, especially in the early stages of the disease. They are situated in the burrows under the conical papillæ and by scraping the infected area until blood oozes from the tissues the mites sometimes may be found in the scrapings.

When cattle are dipped twice for common scab and the disease persists regardless of such treatment, it is advisable to apply treatment for sarcoptic scab.

CONTAGIOUSNESS OF SARCOPTIC SCAB.

Sarcoptic scab is transmissible from one species of animal to another and also from animals to man. Ordinarily when one species of animal contracts the contagion from another species the mites live only a limited time on the newly affected animal. Sarcoptic mites of the horse, sheep, goat, and cat may live on cattle, while those of the horse, dog, and hog are known to be readily transmissible to man.

Sarcoptic scab of cattle is contagious to all classes of cattle and is transmitted by direct contact with animals or objects that are carriers of the mites. While apparently the disease spreads more slowly

than common scab, especially among cattle not closely confined, it makes great headway in herds crowded in yards or stables where the animals come in close contact. In range herds the bulls and old cows are most susceptible to the disease, and the contagion spreads slowly during mild weather. With the advent of cold, stormy weather, however, the contagion may spread throughout the entire herd. The disease develops rapidly under various insanitary conditions, such as crowded or unclean quarters, exposure to cold, inclement weather, insufficient feed of poor quality, or any other circumstance tending to lessen the vitality or functional activities of the animal. When the mites are active the lesions extend rapidly and the entire surface of the animal's body may become involved in 6 weeks.

While the contagion usually is spread by direct contact with infected animals, it also may be contracted from stables or small inclosures in which mangy cattle recently have been confined, or from currycombs, brushes, blankets, mangers, etc. Although the mites do not propagate themselves except on the bodies of animals, the mites as well as their eggs may retain their vitality for a considerable time after they are removed from the body. When exposed to sunlight in dry places the sarcoptic mites live only a few days, but in moist, protected places they may live 3 weeks or even longer. It is evident therefore that all stables and small inclosures occupied by mangy cattle, and all implements and coverings, such as currycombs, brushes, blankets, etc., should be cleaned and disinfected before they are used for clean or dipped cattle. The cleaning and disinfecting for sarcoptic scab should be done in the same manner as for common scab.

TREATMENT FOR SARCOPTIC SCAB.

Sarcoptic mites, probably on account of their burrowing habits, are much more difficult to eradicate than the common scab mites. The dips recommended for common scab will kill sarcoptic mites if the liquid comes in contact with them, but these dips may not reach all the mites at one application. Persistent, thorough, and frequent application of the common dips, however, will effect a cure, especially if all infected parts are scrubbed well with a brush and soaked with dipping solution just prior to the first dipping.

Experience has shown that 4 dippings in either a lime-sulphur or a nicotin dip will cure sarcoptic scab in cattle. The interval between dippings should be from 6 to 10 days. When properly used these dips are not injurious, and cattle may be dipped in them any number of times without other losses than those caused by shrinkage and accidents.

One dipping in crude petroleum usually cures sarcoptic scab, as it seems to destroy the eggs as well as the mites. One of the greatest drawbacks to the use of crude petroleum as a dip is that in some cases it is injurious to the animals.

CHORIOPTIC OR SYMBIOTIC SCAB (TAIL MANGE).

Chorioptic or symbiotic scab, or tail mange, occurs occasionally in cattle but is of less importance than either of the two varieties already described. It is caused by a mite known technically as *Chorioptes bovis bovis*, which under a low-power magnifying glass closely resembles the common scab mite. Though it usually spreads very slowly, the disease is contagious to all classes of cattle. It is not transmissible from one species of animal to another. The mites live on the surface of the skin and produce lesions resembling those of common scab. The lesions usually are found on the tail or limbs and generally remain localized, with little or no tendency toward spreading. For practical purposes it is not necessary to differentiate between chorioptic and common scab because the treatment recommended for common scab will cure the former.

DEMODECTIC (FOLLICULAR) MANGE.

The true nature of demodectic mange, also known as follicular mange, is not often recognized in cattle. The lesions that characterize it are very different from those seen in the other varieties of mange or scab, and the disease usually progresses very slowly. It is said by some observers that generally the lesions appear first on the shoulders and neck in the form of small spherical lumps in the skin, ranging in size from that of a millet seed to that of a pea or larger. These lumps increase in number in progressive cases until in the last stages of the disease they may be present nearly everywhere in the skin, or in some cases there is very little alteration in the size and number of the nodules during a period of 2 or 3 years. The contents of the nodules may be a rather firm kernel, creamy white, of cheesy consistence, or finally the nodules may burst and discharge a creamy, purulent material. Under a high-power microscope numerous small wormlike mites are visible in the material squeezed out of the nodules. To obtain material for examination it may be necessary to cut into the swelling before the contents can be squeezed out.

These parasites are known as *Demodex folliculorum bovis*. Similar follicle mites occur also in dogs, horses, human beings, and in other animals. As in dogs, follicular mange in cattle may be considered as practically incurable, although its progress may be delayed by regular dipping. Cattle in advanced stages of the disease should be killed, mild cases should be segregated and dipped frequently, and the rest of the herd dipped at least once as a precautionary measure. The swellings on the backs of cattle, caused by the presence of the fly larvæ commonly known as warbles, with which most cattle owners are familiar, should not be mistaken for follicular mange.

METHODS OF APPLYING TREATMENT.

Dipping and spraying are the two methods of treatment commonly used for cattle scab. Dipping, which consists in immersing animals in a medicated liquid that will kill the parasites, is the only method recognized by the Bureau of Animal Industry in the official treatment of scabby cattle. It is the most practical and effective known method, because in the dipping vat the entire surface of the animal's body receives a thorough wetting. Dipping plants are usually arranged so that the cattle enter one end of a vat filled with dip through which they swim and leave the vat at the opposite end (fig. 6).

FIG. 6.—Dipping cattle in cement vat. Two dippings, 10 or 12 days apart, may be expected to free a herd from the mites that cause scab.

Spraying is not so economical or effective as dipping, because of the difficulty of thoroughly wetting the hair and skin of cattle with a spray. Much of the dip runs off and is wasted, and unless plenty of it is used and the spraying is continued until all parts are well soaked the treatment will not be effective. Cattle scab can be cured by spraying, however, if the work is done properly. This method is recommended only when the number of cattle is not large enough to justify the owner in providing a dipping vat and no vats are available in the neighborhood. An ordinary hand spray pump (fig. 7) can be purchased for less than $10, or if an orchard-spraying outfit is available it may be used for spraying cattle. Any of the dips recommended for scab may be applied in the form of a spray, and the interval between sprayings should be the same as those between dippings.

All animals in the herd should be treated, regardless of the number showing lesions of scab. One dipping, however, generally is sufficient for cattle not visibly diseased; in other words it is sufficient for cattle that have been exposed to infection but among which the disease has not yet become apparent.

DIRECTIONS FOR DIPPING.

If dipping is to be successful it is necessary to give close attention to details and see that the work is performed carefully and thoroughly. Before cattle are brought to the vat they should be watered and fed, so as not to be hungry or thirsty at the time of dipping; on the other hand, when dipped they should not be gorged with feed and water. If they are watered and fed from 2 to 4 hours before dipping, they are likely to be in the best condition for the operation. When cattle have been driven and are hot at the time of reaching the vat they should be allowed to cool off before they are dipped, as it is dangerous to dip them while they are overheated. When the nights are cold dipping should be finished for the day early enough for the animals to become dry before sunset.

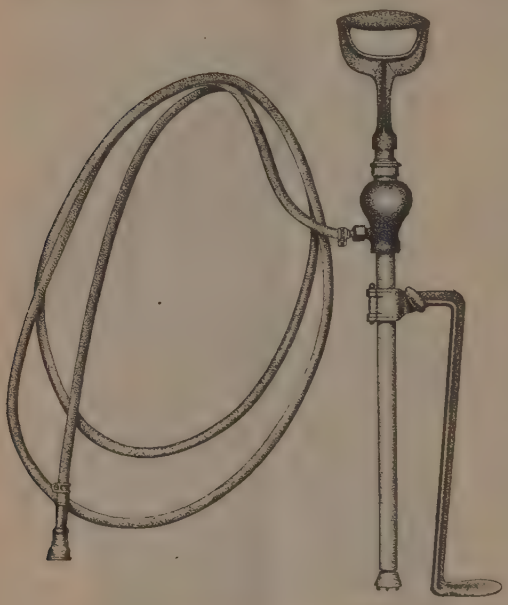

FIG. 7.—Small spray pump suitable for spraying cattle.

The dip in the vat should be maintained during dipping at a depth of 70 or 80 inches, or a depth sufficient to swim the tallest animal to be dipped. The quantity of dip necessary to obtain that depth should be ascertained before it is prepared. The average 1,000-pound, short haired steer will carry out and retain about 2 quarts of dip, and a long-haired one of the same weight will retain about 1 gallon. The total estimated quantity of dip which the animals carry out and retain, plus what is required to charge the vat, should equal the total, if none is lost by leakage or otherwise wasted.

The capacity of the vat is usually calculated in the following manner: Multiply the average length in inches by the average width in inches, then the product by the depth in inches; this will give approximately the number of cubic inches of space to be filled with dip. Divide this by 231 (the number of cubic inches in a gallon), and the result will be approximately the number of gallons of dip required to charge the vat. To obtain the average length add the length at the bottom to the length at the top (that is, at the line to which the vat is

to be filled), and divide the sum by 2. Obtain the average width in the same manner. The depth should be taken at the middle of the vat, and should be from bottom to dip line only and not the top of the vat. Likewise, in determining the length and width, measure only the space to be filled with liquid and not above that line. The capacities of the various tanks are obtained by a like process. Gauges or rods should be prepared and marked to show the number of gallons at various depths in the vat and tanks.

After the vat is filled to the required depth the contents should be mixed well by stirring, in order that the dip may be of uniform strength and temperature throughout. A good method of stirring the dip is to take a pail or empty dip container in which a wire bail has been fastened, attach a rope or dipping fork to the bail, allow the vessel to fill and partially sink, then drag it rapidly from one end of the vat to the other, repeating the operation several times. Stirring plungers also are useful implements, and, as they are easily made, one or more should be provided at every vat. Their use is similar to that of the dasher of an old-fashioned hand churn. The plunger is pushed to the bottom of the vat and raised rapidly, the process being repeated as the operator moves slowly along the vat. The style shown in figure 8 is the one commonly used.

FIG. 8.—Stirring plunger for mixing liquids in the vat.

Before beginning operations the pens, chutes, slide board, vat, etc., should be examined for projecting nails, broken boards, or any object that may puncture or wound the cattle, as the dip may injure those having fresh wounds. The animals should be handled as carefully as possible, although in dipping wild range cattle the attendants can exercise very little control in the matter. Range cattle, not accustomed to being handled, are easier to dip than tame farm animals, as they go through the chutes and enter the vat more readily than the tame ones. After the animals have started running through the chute it often is necessary to restrain them to prevent their piling up and drowning in the vat. At large dipping plants a gate usually is provided in the chute near the intake to the vat so that the animals in the chute may be held back and allowed to pass only as room is made for them in the vat. If the chute has no gate, a bar which can be slipped across the chute between the side boards will answer the purpose. Gentle farm animals, and especially old milch cows, usually do not enter the vat readily—in fact it is often necessary to push them on the slide board.

Whenever there are crusts or hard scabs they should be broken and hand dressed with a solution of the dipping fluid so as to soak the affected parts well before the cattle are dipped. Visibly affected cattle should be held in the vat 2 or 3 minutes and their heads submerged at least once, but only for an instant, and assistance should be rendered promptly if they appear to be strangling. Men with dipping forks should be stationed along the vat to duck the head of the animal and to keep the animal's entire body submerged except its head. This may be done by placing the dipping fork over the withers and pushing the animal under the dip. The two styles of dipping forks shown n figure 9 are the ones commonly used. They may be bought ready-made or may be made by any blacksmith.

FIG. 9.—Two styles of cattle-dipping forks.

After the cattle leave the vat they should be held in the draining pens until all surplus dip has drained from their bodies.

The dip in the vat, regardless of the number of animals that may have been dipped in it, should be changed as soon as it becomes filthy. In cleaning the vat the entire contents, including all sediment and foreign matter, should be removed.

DIPS FOR CATTLE SCAB.

In selecting a dip for cattle scab the conditions under which it is to be used should be considered. If the dipping plant is supplied with soft water any of the dips recommended for scab may be used, but if the water is very hard the dip that mixes best with the water available should be selected. Hard water may be "broken" by using sal soda or lye, but no more should be added than is required to soften the water. From 1 to 4 pounds of sal soda to each 100 gallons of water usually is sufficient. The lime-sulphur dip mixes well and may be used in hard water without injury to the animals from that cause, but it is more effective when used in soft water. The nicotin dips are suitable for use in any reasonably good water. While it is possible to cure scab with coal-tar-creosote dips if they are used in soft water,

they sometimes injure animals; they may fail to cure the disease when used in some of the hard waters, and apparently for the reason given in the next paragraph they can not be depended upon even when soft water is used.

Dips deteriorate by use; that is, after a number of animals have passed through the vat the active principle of the dip falls below the standard required for effective work and under certain conditions some of the dips may injure the animals. Consequently the Department of Agriculture does not give permission for the use of any dip in the official dipping of cattle for scabies unless it has been shown to the satisfaction of the Bureau of Animal Industry (1) that the strength of the dip when diluted ready for use may be determined satisfactorily in the field by the use of a practical, portable testing outfit; (2) that under actual field conditions the dipping of cattle in a solution of definite strength will eradicate scabies effectually without injuring the animals. At present the only cattle-scabies dips that fulfill these requirements are lime-sulphur and nicotin.

LIME-SULPHUR DIP.

In dipping cattle for scabies the lime-sulphur dip should be used warm. The temperature of the dip while the animals are in it should be maintained at from 95° to 105° F.

Lime-sulphur dip is made in the proportion of 12 pounds of unslaked lime (or 16 pounds of commercial hydrated lime) and 24 pounds of flowers of sulphur or sulphur flour to 100 gallons of water. The lime and sulphur should be weighed and the water measured; do not trust to guesswork. Slake the lime in a shallow, water-tight box or tank and add water enough to form a thin paste. Sift the sulphur into the paste and mix well with a broad hoe until a mixture of about the consistence of mortar is formed, adding water as required. Put the mixture into 30 gallons of boiling water, adding it slowly so as not to interrupt the boiling, and boil until the sulphur disappears from the surface. The boiling should be continued from 1½ to 2 hours without cessation, and the mixture stirred to prevent settling and caking on the bottom. When the sulphur has disappeared from the surface and the mixture is of a chocolate or dark-amber color the boiling should be discontinued.

The contents of the boiling tank should be drawn off or dipped out and placed in the settling tank and allowed to stand until all solids have settled to the bottom and the liquid is clear. The use of some sort of settling tank provided with a bunghole is an absolute necessity, unless the boiler is so arranged that it may be used for both boiling and settling. An ordinary water-tight barrel will serve very well for a settling tank at a small vat. A settling tank of any kind should have an outlet at least 4 inches from the bottom in order that the clear liquid may be drawn off without its becoming mixed with any of the

sediment. (See fig. 10.) Drawing off the liquid as indicated above has an advantage over dipping it out, for the reason that in the latter case the liquid is stirred more or less and mixed with the sediment. The prime object is to get the clear liquid without any sediment; the latter under no circumstances should be allowed in the dipping vat, as it may injure the animals.

When fully settled draw off the liquid into the dipping vat and add warm water enough to make a total of 100 gallons of dip. When mixed and cooked as specified above the concentrate is 3⅓ times the

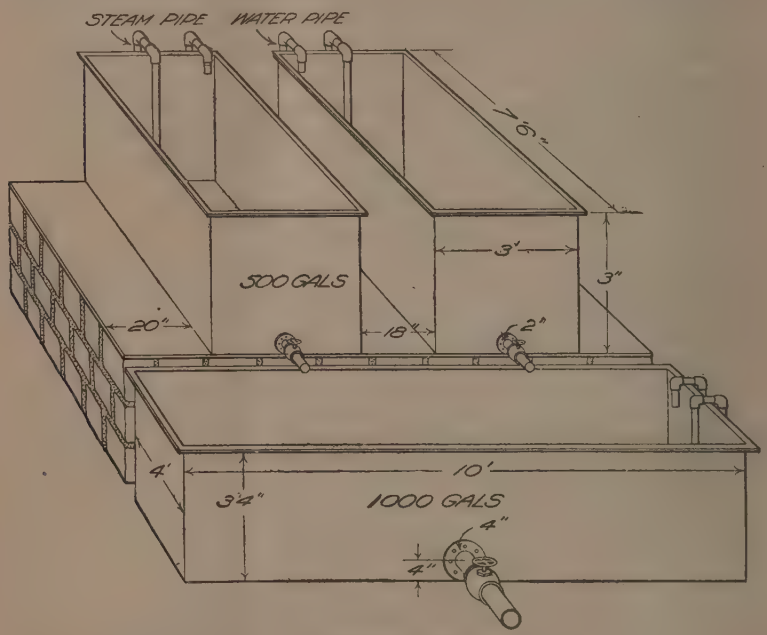

FIG. 10.—Cooking and settling tanks.

strength required for the dip in the vat, so that to every 30 gallons of such concentrate 70 gallons of warm water should be added to make a dip of the required strength.

In preparing lime-sulphur dip in large quantities several hundred gallons of concentrate are often made at one time in a single large cooking tank. The quantity made at one boiling is limited only by the facilities at hand. If the boiling tank is of sufficient capacity, a large enough quantity of the dip should be cooked at one time to dip the herd. The quantity of mixture in the cooking tank may be varied at will, but the proportions of the various ingredients should not be altered.

Proprietary brands of lime-sulphur dip may be purchased, and many of them are equal to or even better than the homemade product. Ready-prepared dips should be diluted and used in accordance with instructions on the container.

NICOTIN DIPS.

The nicotin dips are sold under various trade names, and farmers and live-stock growers are more or less familiar with them from using them as dips for animals and as insecticides for insect pests of plants. When diluted with water so that the solution contains not less than five one-hundredths of 1 per cent of nicotin, they are efficacious remedies for cattle scab. If used much stronger than that they may injure cattle, especially if the animals are dipped while hot, but if properly used and maintained at proper strength they cause no injury. A field test has been designed by one of the large manufacturers of nicotin dips so that the percentage of nicotin in the dipping bath may be ascertained at the vat side at any time. Nicotin dips should be used in accordance with the instructions printed on the label of the container. Do not use any preparation whose strength is not given on the label.

Nicotin dips are used warm, but should not be heated above 110° F. During dipping operations for scab the temperature of the nicotin dip should be maintained at from 95° F. to 100° F.

Sulphur is sometimes added to nicotin dips in the proportion of 16 pounds of flowers of sulphur to 100 gallons of diluted dip. Very little of the sulphur is dissolved in the dip, but part of it remains in suspension in the bath during dipping and becomes lodged on the skin of the animal, where it remains for a long time with beneficial effect

CRUDE-PETROLEUM DIPS.

As two dippings in either of the dips already described will cure chorioptic and common scab, the crude-oil dips are not commonly used for either of these varieties of cattle scab. Crude oil is very useful, however, in treating cattle for sarcoptic scab and has proved to be an effective remedy for that disease. One of the greatest drawbacks to its use is that the oil is liable to injure animals, especially if freshly treated cattle are moved rapidly, exposed to bright sunshine, or become chilled.

Unprocessed crude petroleum is the natural crude oil which has not been subjected to any manufacturing process and it is the most effective crude-oil dip. However, processed crude petroleum, which is the residue from the manufacture of gasoline and other light hydrocarbons, is commonly used as a cattle dip and is effective in eradicating sarcoptic scab of cattle. There are also on the market several proprietary brands of crude-petroleum dips, consisting of processed crude oil to which other ingredients have been added.

In dipping cattle in crude-petroleum dip fill the vat with water to within 1 foot or 18 inches of the dip line and then add the oil until the surface of the dip is flush with the dip line. The oil floats on the water, forming a layer from 12 to 18 inches deep, depending on the quantity added, and as the animals pass through the vat their bodies become coated with oil. The oil dips are used cold and one dipping usually is sufficient to cure sarcoptic scab.

When cattle are dipped in any of the crude-petroleum dips a cool, shady place should be provided near the dipping vat where they may be quiet and protected from the sun for several days. If this is impossible the oil dips should not be used, as serious injury is liable to result from exercise or exposure to bright sunshine soon after dipping in oil.

DIPPING PLANTS.

The farmer who has but a small number of animals to dip may use a portable galvanized-metal vat (fig. 11). These vats may be purchased ready-made, and they will answer the purpose very well for

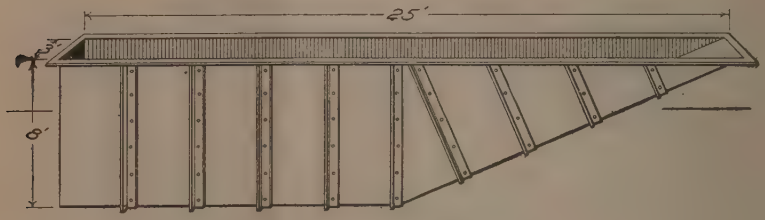

FIG. 11.—Portable galvanized-metal dipping vat.

dipping small lots of light or medium-weight cattle. After digging a trench and setting the vat so that the top is flush with the surface of the ground, a chute and a slide board should be provided as a means of getting the animals into the vat.

A permanent dipping plant is much more satisfactory, and when a number of farmers in a community wish to dip their cattle a good plan is for them to contribute in proportion to the number of cattle owned and use the fund in building a community dipping plant.

Two styles of dipping plants are shown in the plans (figs. 12 and 13). Either is suitable for dipping cattle or horses for any purpose. The chutes, draining pens, etc., shown in one set of plans, may be substituted if desired for those shown in the other.

SELECTING A LOCATION.

In selecting a location for a dipping plant the fact that animals work better upgrade should be considered, and the corrals and running chute should slope up to the entrance end of the vat. The vat should be on level ground, preferably extending north and south, with the

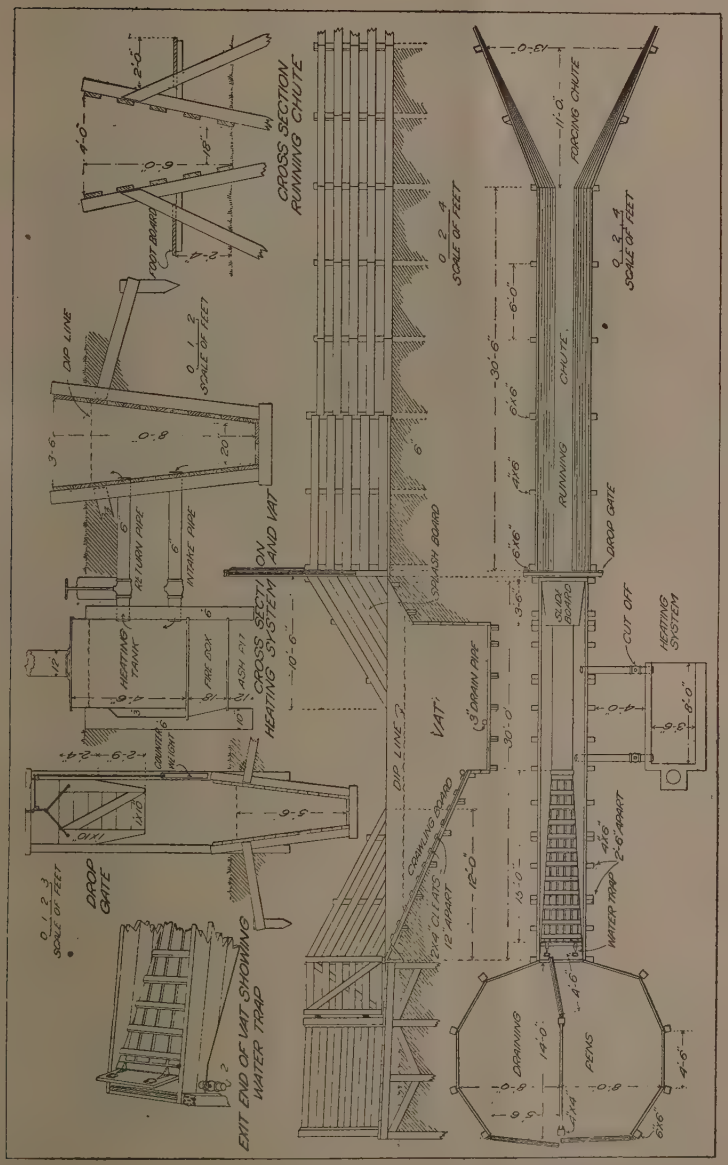

FIG. 12.—Plan of cattle-dipping plant with wooden vat.

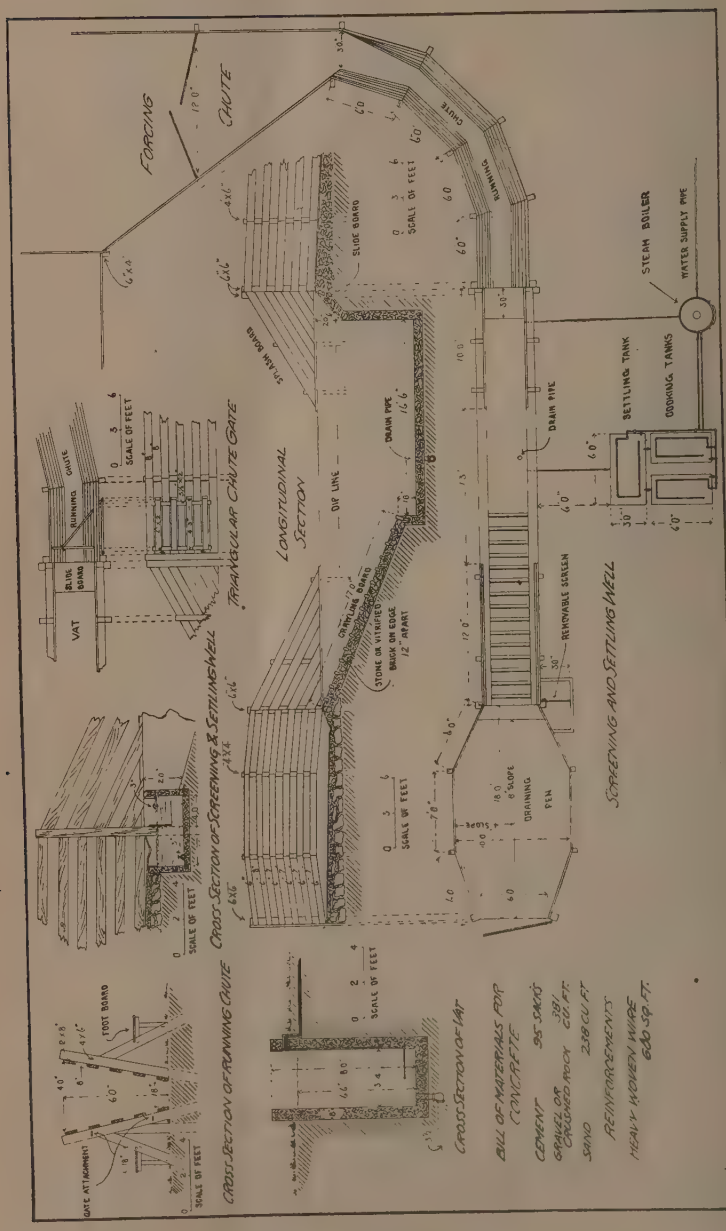

Fig. 13.—Plan of cattle-dipping plant with cement vat.

entrance at the south and the exit at the north, as it has been observed that animals work better when not facing the sun. A considerable quantity of water is used in dipping, so the dipping plant should be close to an adequate supply. The vat, however, should not be built on low, marshy land or where flood waters overflow.

CORRALS AND CHUTES.

The set of receiving corrals, into which the animals are driven preparatory to dipping, as well as the set of holding corrals, into which they go from the draining pens, should each be large enough to hold the largest herd to be dipped. They should be constructed so that there may be the least possible numbers of corners in which the cattle may become crowded and injured.

The proper design and construction of the chutes is important, because improperly constructed chutes add greatly to the difficulty of getting cattle into the vat and often cause rough handling of the animals. The running chute should be at least 30 feet long and preferably curved to prevent the approaching animals from seeing the vat. Two styles of running chutes and crowding chutes are shown in the plans, and dimensions and structural details are given. Two styles of chute gates also are shown. Most stockmen probably prefer the triangular gate. A drop gate like that shown in figure 12 may be adapted for use either as a check gate in the chute or as a holding gate in the vat. A holding gate in the vat at the beginning of the exit incline should be provided in order that visibly affected animals may be held in the dip the required length of time.

DRAINING PENS.

When cattle emerge from the vat they carry out some of the dip, which runs off their bodies very rapidly. The dip should be saved and returned to the vat, not only because it may be used over and over again, but because if it is allowed to drip off in the holding corrals it will collect into pools, from which the animals may drink with possibly injurious results, and even if no cattle are injured in that way the mudholes which form are highly objectionable. Draining pens with water-tight floors sloping toward the vat or draining wells should be provided to catch and return the dip to the vat. The size shown in the plans may be increased or decreased to correspond to the length of the vat. The floors of the pens may be made of lumber or cement and should have settling wells or water traps to prevent rain water from running into the vat and diluting the dip. A design of a settling well is shown in connection with the cement vat and one of a water trap with the wooden vat. The settling well may be used with the wooden vat, in which case the water trap would be unnecessary, as the settling well serves the same purpose.

In constructing the draining pens of cement it is advisable to build the outer walls in the same manner as the foundations for a house, except that they are to be 8 inches thick. The space inside the walls is then filled with gravel to the required height and the sloping floors laid on the tamped gravel. To prevent slipping, the cement floors should be roughened with a stiff broom while the concrete is soft, or a coat of pebble dash may be applied. If wooden floors are used they should be double, with a layer of tar paper between the two floors. Rough lumber may be used for the lower floor but the top one should be of matched boards 1 inch thick. Cleats should be nailed on the floor to prevent the cattle from slipping.

VATS.

The dipping vat may be constructed of either cement or lumber, the former being preferable, as when properly made it is more durable and in many other ways more satisfactory than the latter. The sides may be perpendicular, as shown in the plans for a cement vat (fig. 13), or sloping as shown in those for a wooden vat (fig. 12). Sloping sides for either cement or wooden vats are generally considered to be more desirable than perpendicular ones. Both styles, however, are shown in the drawings, because some stockmen prefer vats with perpendicular sides. The dimensions shown in the cross section of the wooden vat may be followed in constructing a cement vat with sloping sides.

The length of the vat may vary from 24 to 100 feet, depending on the number of cattle to be dipped. The top may extend from 9 to 18 inches above the surface of the ground or may be flush with it. A vat of the former kind affords better conditions for handling the cattle than one of the latter kind. If it is desired that the top be flush with the ground the vat should be built so that it extends 5 inches above the natural surface of the ground, which is then graded up with gravel or cinders, and a dry path along each side of the vat thus provided.

The slide board should be made of or covered with a smooth-surfaced material, such as planed lumber or sheet metal. A piece of boiler plate makes an excellent slide board. The dimensions of the slide board shown in connection with the cement vat are those commonly used. A short, steep slide board causes the animals to plunge abruptly into the dip, while a long, gradual slope allows them to slide in more gently. The short, steep slope has the advantage that the animals can not brace themselves on it for a leap so easily as on the long, gradual slide. The exit incline or crawling board should be about 16 feet long, so that the incline may not be too steep.

If permanent pipes are used for conducting water and dip to the vat they should be laid so as not to act as obstacles to the men working along the vat, but they should enter the vat above the dip line so that

any leakage may be detected. There should be no obstruction in the path along both sides of the vat; neither should there be over the top of the vat any crosspieces that may interfere with the proper handling of the cattle while they are in the dip.

The wooden vat shown in the plans has sloping sides, but, as already stated, they may be perpendicular if desired. When soft wood is used for the frame timbers they should be 6 by 6 inches, but if hard wood is used 4 by 4 inch timbers are sufficiently large for the purpose. Cedar posts make good framing timbers, as they do not rot rapidly. Matched planks 2 inches thick should be used in building the vat, and they should be beveled so that all joints and seams may be properly calked with oakum and rosin or similar material.

A water trap with hinged cover is shown in the exit incline of the wooden vat. While dipping is in progress both the cover and the valve to the drainpipe should be closed, but when dipping is finished for the day both should be opened so that water from the draining pens in case of rain may not run into the vat and dilute the dip.

When homemade lime-sulphur dip is to be used it is necessary to provide cooking tanks (fig. 10). The cooking may be done in open boilers having a fire box under each, or live steam may be piped into them for boiling the dip. It is also necessary to provide some means of heating the dip in the vat. Two systems of heating the dip in the vat are shown in figs. 12 and 13. When the open-tank heating system, shown in the plans of a wooden vat, is used, settling wells are not necessary, as the heating tank answers the purpose of a settling well. This system has an advantage over the old-style coil heater in that it is easy to keep the pipes from clogging.

The heating system shown in connection with the plans for a cement vat is the one commonly used. When steam is used the boiler should have a capacity of at least 25 horsepower. The steam pipes should extend along the floor of the vat at least two-thirds of the length and be provided with openings for the escape of steam into the dip. A check valve should be placed in the steam line to prevent dip from the vat from flowing into the boiler when the pressure is low. The water condensing from the steam passing into the vat dilutes the dip to a slight extent, and for this dilution an allowance should be made in replenishing the dip.

The trench for the vat should be excavated so that the inside dimensions correspond to the outside dimensions of the completed vat. If the sides of the trench are reasonably firm they may be used for the outer walls of the form, but in all cases in which the vat is extended above the surface of the ground it is necessary to build forms extending from the ground surface to the top of the vat. If the soil is sandy or the walls cave in it will be necessary to use outer forms, in which case the trench should be wide enough for them.

The forms usually are made of 1-inch boards and 2 by 4 inch braces, but as a supply of 2-inch lumber is necessary for the corrals and chutes, some of it may be used first for the forms and afterwards for constructing corrals and chutes. Two methods of bracing the forms are illustrated (figs. 14 and 15).

Bolts for fastening the slide board and the drain and other pipes should be placed in position in the forms before the concrete is laid. The concrete side and end walls may be reinforced with heavy woven wire, in which case the reinforcements should be placed properly in the forms so that they may be embedded in the middle of the walls.

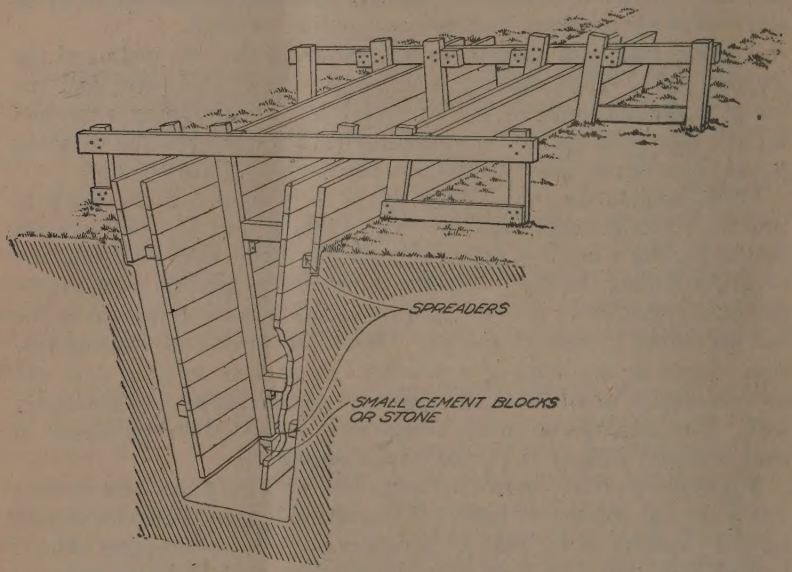

FIG. 14.—Section of trench for cement vat with sloping sides, showing the forms in place and one method of bracing.

The concrete for dipping vats should be made of 1 part of Portland cement by measure, 2½ parts of sand, and 4 parts of screened gravel or crushed stone. The sand should be coarse, clean, and free from foreign matter. The crushed stone or gravel may vary in size from one-quarter to 1 inch in diameter. The mixing should be done on a smooth, tight platform and the sand and rock measured separately in a bottomless box 2 feet long, 2 feet wide and 1 foot deep, having a capacity of 4 cubic feet. For the 2½ cubic feet mark the inside of the box 7½ inches up from the bottom. Each sack of Portland cement is considered to be equal to 1 cubic foot. Mix the sand and cement thoroughly, add the crushed stone (previously drenched with water), and mix the whole mass by turning it several times with shovels.

Then add water in a depression made in the center of the pile and mix well by turning several times with shovels, adding water enough during the mixing to make a "quaky" or thin, jellylike mixture.

The placing of the concrete in the forms should be commenced as soon as the mixing is finished. The floor and exit end should be laid first and the concrete well tamped. In filling the forms the concrete should be well settled into place by spading rather than by tamping, and special attention should be given to spading next to the inside forms to force the coarse particles back and allow the sand-cement mortar to form a dense, water-tight surface. An old hoe straightened

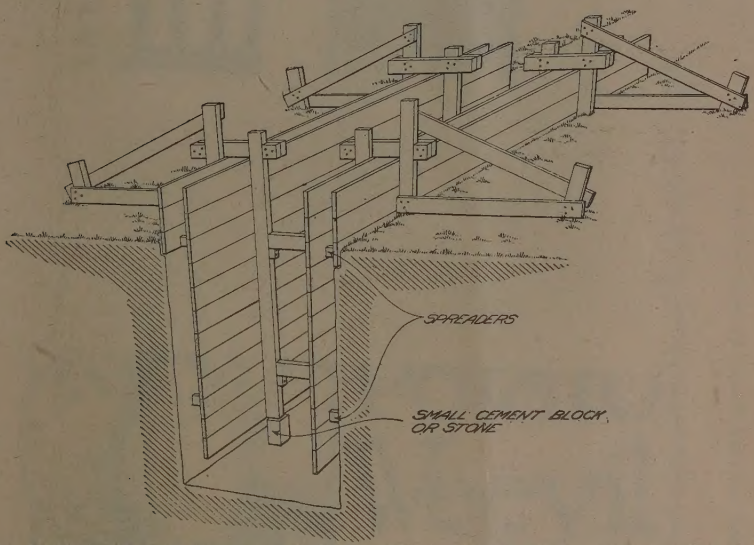

FIG. 15.—Section of trench for cement vat with perpendicular sides, showing forms in place and another method of bracing.

out makes a good spading tool, as the handle is long enough to reach the bottom of the forms. If it is necessary to stop work for the day before the forms are filled the surface of the concrete in the forms should be roughened with a stick. Just before placing additional concrete, wash the roughened surface and paint it with cement and water mixed to the consistence of thick cream. Leave the forms in place 2 or 3 days, if possible, and wet the concrete daily. After the forms are removed, dampen the surface of the concrete and apply a finishing coat composed of 1 part of cement and 2 parts of sand, or mix cement and water to the consistence of cream and apply it, brushing well to form a smooth surface.